

CS474/674 Image Processing and Interpretation

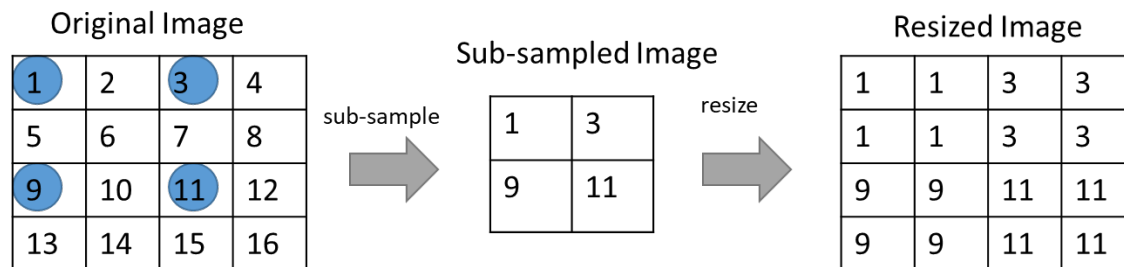
Fall 2025 – Dr. George Bebis

Programming Assignment 1

Due Date: 9/29/2025 @ 11:59pm

1. [25%] Image Sampling

Write a program to change the spatial resolution from 256 x 256 to 128 x 128, 64 x 64, and 32 x 32 pixels using sub-sampling by a factor of 2, 4, and 8 correspondingly. For comparison purposes, resize the sub-sampled images back to the original size 256 x 256 (as shown in the lecture). Show your results using the “**lenna**” and “**peppers**” images from the image gallery. The example below shows how to sub-sample and resize an image assuming a factor of 2. Use the same idea for factors 4 and 8. Discuss your results.



2. [25%] Image Quantization

Write a program to reduce the number of gray levels L in a PGM image from $L=256$ to: (i) $L=128$, (ii) $L=32$, (iii) $L=8$, and (iv) $L=2$. Show your results using the “**lenna**” and “**peppers**” images. For comparison purposes, subsample the gray-levels to better visualize the quantized images (e.g., if $L=128$, you can use 0, 2, 4, ..., 254 with $Q=255$ in the PGM file instead of 0, 1, 2, ..., 127 with $Q=127$; similarly, if $L=2$, you can use 0, 127 with $Q=255$ instead of 0, 1 with $Q=1$). Discuss your results.

3. [50%] Histogram Equalization

- Implement the histogram equalization technique. Debug your algorithm using a “test” image (e.g., 5 x 5) to make sure that it works correctly.
- Perform histogram equalization on the “**boat**” and “**f_16**” images
- Show all histograms before and after equalization and discuss your results.

4. [20% Extra Credit] Histogram Specification

- (a) Implement the histogram specification technique. Debug your algorithm using a “test” image (e.g., 5 x 5) to make sure that it works correctly.
- (b) Perform histogram specification on “**boat**” and “**f_16**” images. Assume that the specified histogram for the “**boat**” image is the histogram of the “**sf**” image and that the specified histogram for the “**f_16**” image is the histogram of the “**peppers**” image.
- (c) Show all histograms before and after specification and discuss your results.